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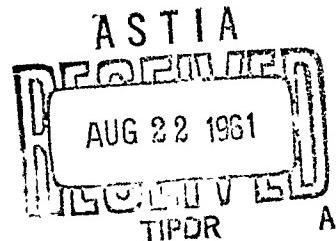
# INDUSTRIAL ENGINEERING DIVISION

Lake City Arsenal

## PRODUCT ENGINEERING DESIGN STUDY OF

CARTRIDGE, 37MM, SPOTTING, XM415

I. E. D. REPORT NR. 61-12



PROJECT: 56-32 4010.15.0106.1.01.62

JULY 1961

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INDUSTRIAL ENGINEERING DIVISION  
LAKE CITY ARSENAL  
INDEPENDENCE, MISSOURI

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CARTRIDGE, 37MM, SPOTTING, XM415

Industrial Engineering Report  
61-12

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1. ABSTRACT:

This report covers the Industrial Engineering Division, Lake City Arsenal, product engineering design study of Cartridge, 37mm, spotting, XM415, which is a sub-caliber component of the XM29 Weapons System. Experience gained at Lake City Arsenal in the production engineering and initial manufacturing phase of Cartridge, 20mm, spotting, XM101, was fully utilized and applied. Altogether some twenty-one (21) completely dimensioned and annotated component drawings were generated, but no actual metal parts were made or tested.

The modified cartridge case is similar in basic design to the 20mm XM154. Two case plugs of different internal volume fit the case body to provide the two ranges required of the spotter round. The case wall thickness is the minimum which will safely withstand anticipated excess chamber pressure requirements without additional heat-treatment.

The projectile was simplified and improved by changing to a conventional one-piece body with a male threaded fuze intruding into the mouth. The external configuration closely resembles the XM101 projectile but for size; weight and c.g. are unchanged from the Picatinny Arsenal XM415 projectile. Several internal changes were made for simplification of manufacture, assembly, or both, and several

components were eliminated thereby. The counterweight was changed from lead to D-38 which was a major factor in the increase of the payload by 23% over the Picatinny Arsenal projectile.

No assembly drawings other than a sectioned layout were generated during this project, and if desired, will require additional funding.

A study to modify the T336E7 fuze to the XM415 projectile is in progress and will be reported separately.

The subject study was completed in time that changes can be incorporated by Picatinny Arsenal into the R&D and ET-UT quantities if desired.

### II. INTRODUCTION:

Because of the experience gained by the Industrial Engineering Division, Lake City Arsenal, in the production engineering and initial production phase of the Cartridge, 20mm, spotting, XM101, this arsenal was funded by Picatinny Arsenal, ORDBB-TW4, to conduct a production engineering design study of the subject cartridge, and supply Picatinny Arsenal with a set of engineering drawings.

The function of the XM415 cartridge is to provide spotting (i.e., direct range determination) information for the XM29 Weapons System. To accomplish this a "Dial-the-Zone" cartridge case was originally designed by Picatinny Arsenal to cover the two ranges of

the major weapon. However, by the time IED began the subject engineering study this "dual-zone" case had been dropped in favor of two separate cartridges, one for each zone.

The XM415 projectile differs from the XM101 in that the spotting mix is ejected rearward and upward, thereby substantially increasing the probability of visual observation under all conditions of weather and terrain. The rear ogive of the XM415 projectile body is opened by a small PETN charge in the front of the tail boom.

After completion of this study, drawings were received from Picatinny Arsenal showing a cartridge case (Drawing AA-44-1666) similar in external configuration to the LCA case generated in this study. The wall section is much thinner and heat-treatment is required for the necessary strength. A case mouth anneal is not indicated. Two case plugs, metering disc and metering disc cover incorporating LCA redesign features, were then made up for the PA case, theorizing that the gun chamber configuration may have been frozen.

Experience with the XM154 case and similar items indicates that warpage caused by heat-treating will substantially increase the inspection rejection rate. The PA case (Drawing AA-44-1666) is 1.6" longer than the LCA case which increases material cost by 15%, plus the alloy costs. The taper of the PA case is substantially less than the LCA design, and increased extraction problems are anticipated thereby.

### **III. PROCEDURE:**

All Picatinny Arsenal component and assembly drawings were studied in detail as to materials used, methods of manufacture required, functioning of each item and assembly, special assembly and inspection techniques required, and general over-all practicality.

During the entire study and subsequent redesign, parameters established by Picatinny Arsenal were closely adhered to.

No actual components were fabricated, the entire operation being a paper study.

Completed component drawings were delivered to Picatinny Arsenal, Messrs. E. Roof and D. Trevarrow, on 13 July 1961, and the various recommended changes from the Picatinny Arsenal design thoroughly discussed.

### **IV. RESULTS OF STUDY:**

A brief resume of changes made, with reasons, to the major components follows:

#### **a. Case Body, Drawing LCA-SK-423**

<u>Change</u>	<u>Reason</u>
Increased taper	Better extraction
Standard threading	Lower tooling cost
No heat-treatment	Lower processing cost and rejection rate
Carbon steel	Lower material cost
Reduced over-all length	Material & machining costs reduced
Rimless configuration used	Savings in material and processing realized.

b. Case Plug, Drawing LCA-SK-421 (long range)  
LCA-SK-422 (short range)

<u>Change</u>	<u>Reason</u>
Igniter tube eliminated	Improved ignition and decreased velocity dispersion at less cost.
Carbon steel	Lower cost
No heat-treatment	Lower processing cost & rejection rate.
Firing Plug (Dwg. 74-2-78M) eliminated	Firing pin impinges directly on primer. Less cost & more positive action.
Four (4) torque holes are used on the long range plug, two (2) only on the short range plug.	Positive night identification
Counterbore removed from torque hole	Simplified tooling & lower cost.

c. Metering Disc, Drawing LCA-SK-424

<u>Change</u>	<u>Reason</u>
Single size & same number of holes	Reduced tooling & production costs
No trepanning	Lower costs
Fool-proof assembly	Same disc used for both ranges, no chance of mistake in loading.

d. Metering Disc Cover, Drawing LCA-SK-420

<u>Change</u>	<u>Reason</u>
Thickness increased to .005 from .003 used by Picatinny Arsenal	Improve ignition
One cover for both ranges	Simplify production & loading, and reduce costs.

e. Projectile Body, Drawing LCA-SK-446

<u>Change</u>	<u>Reason</u>
Eliminate threaded juncture in center of body	Concentricity requirements cannot be maintained in production. Adapter (PA Dwg. AA-44-1554) eliminated. Improved body security. Improve interior ballistics as body O.D. can be held to closer limits. Improve exterior ballistics as the thread concentricity problem is eliminated.
Moved obturating band rearward	Reduces length of case as projectile intrusion is less. Material and machining costs reduced thereby.
Changed material of the counter-weight (P.A. "insert" ) LCA-SK-443	The volume saved thereby is added to the payload, increasing it by some 23%.
Visual effectiveness increased	The increased volume (23%) of spotting mix will substantially increase the display. Observation of the projectile under adverse weather and terrain conditions, and in the Arctic, should be greatly improved.
[ Payload Volume: P.A.: 1.567 cu. in. L.C.A.: 1.919 cu. in.]	
Band seat configuration	A conventional double-undercut band seat was added to assure band security. Obturation is achieved by interference rather than by gas pressure as on the PA projectile. It is believed the PA band will come off causing external ballistic problems.
Band material	Teflon instead of geon is shown as the banding material. Experience with geon in the XM101 program indicates that it scuffs off easily in the barrel and is a cause of velocity dispersion. If teflon is unacceptable, a 10/1 Pb/Sn alloy band is recommended.
Body material	Changed to C-1030-40 steel rather than a "resulphurized" grade, which is subject to seams; causing security problems when fired.

<u>Change</u>	<u>Reason</u>
Simplified charging and loading	Encapsulation of ejection charge eliminated. The black powder is directly loaded into the body during projectile charging & assembly sequence. Ejection charge volume is the same as on the PA projectile and is placed within a steel sleeve which also acts as a support for the counterweight.
External configuration	Much the same as the current XM101 projectile, which closely matches the exterior ballistics of the major round. This configuration also contributes toward increased "payload".
External scoring	Removed internal score marks from critical thread area. Simplified machining.

f. Igniter Tube, Drawing LCA-SK-445

<u>Change</u>	<u>Reason</u>
Simplified configuration  THE ORIGINAL DOCUMENT WAS OF POOR QUALITY. BEST POSSIBLE REPRODUCTION FROM COPY FURNISHED ASTIA.	The rear portion of the tube is flanged outward so it will seat on a shoulder in the tail boom (LCA-SK-444). This eliminates one part (PA AA-44-1250) and a silver soldering operation.
Threads eliminated	As the igniter tube is self-supporting, the retaining nut at front of igniter tube is unnecessary. The counterbore in the counterweight is also eliminated.

g. Tail Boom

<u>Change</u>	<u>Reason</u>
Thread pitch to 24/in	Increased strength
External configuration	Changed to conform to rear of projectile body. This will also permit easier entrance of air into fins.

<u>Change</u>	<u>Reason</u>
Direct charge PETN	Eliminate separate cup and disc, thereby lowering cost by elimination of these parts.
Drill point in PETN cavity	Facilitates production and eases inspection.
Front end configuration	A crimp type configuration was added to the front end to hold igniter tube and facilitate automatic remote handling during assembly operations. Security of boom and igniter tube assembly is increased.

h. Tail, Drawing LCA-SK-447

<u>Change</u>	<u>Reason</u>
Leading edge radius	Change to a "V" edge to facilitate production and inspection.
Leading edge sweepback	Leading edge tilted back 30° to enhance aerodynamics.
Thread pitch to 24/in	Increased strength
Reduced over-all diameter	To minimize concentricity tolerance build up.
* 6 - Fin	Data indicated 6-fin type superior to 4 fins in availability of area to prevent side-draft or yaw.
* Fin caps	Caps act similar to a shroud without as great drag.
* These changes permitted shortening of fin length thus decreasing cost of expensive extruded material, but will require a length of boom as per LCA-SK-444. Should 4-fin tail (LCA-SK-451) be adopted, boom will need be as per LCA-SK-439.	

V. CONCLUSIONS:

It is believed that changes developed by the subject production engineering design study will improve the ballistic reliability and producibility of Cartridge, 37mm, spotting, XM415, without significant change in the required military characteristics, and this at a substantially lesser cost per round.

VI. RECOMMENDATIONS:

It is recommended that:

- a. A small test quantity of the LCA modified Cartridge, 37mm, spotting, XM415 be manufactured for comparative ballistic test at APG.
- b. Funds remaining on this project be expended on a study toward modifying the T336 fuze for use with the subject cartridge.

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VII. APPENDIX A.

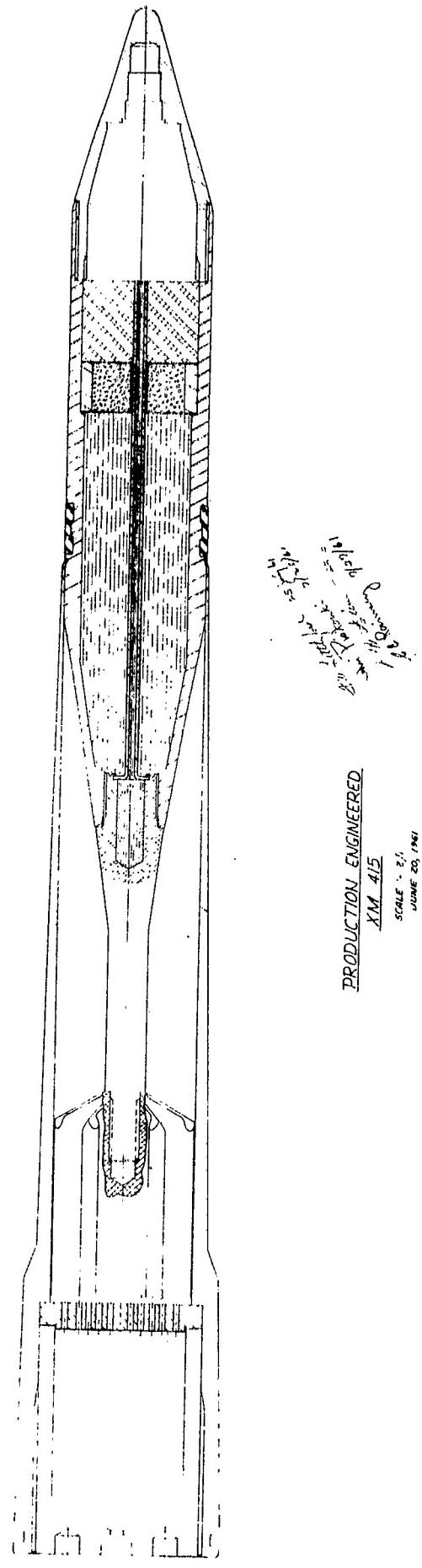
**Sketches**

LCA-SK-419 through LCA-SK-428

LCA-SK-439 through LCA-SK-451

Unnumbered Sketch (Assembly)

AA-44-1666



PRODUCTION ENGINEERED

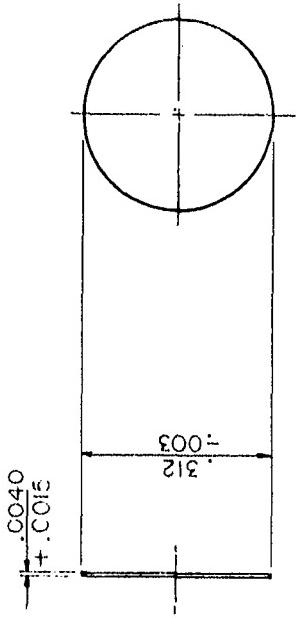
XM 415

SCALE 1:1  
JUN 20 1967

REVISIONS	
SYM	DESCRIPTION

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NOTES :-

- 1 - SPECIFICATIONS MIL-G-2550, MIL-STD-8 AND LCA-PD-1 APPLY.
- 2 - MATERIAL :— PAPER / FOILING). TYPE I CR II, (COLOR, RED), SPEC JAN-F-224, EXCEPT FOR THICKNESS REQUIREMENT.

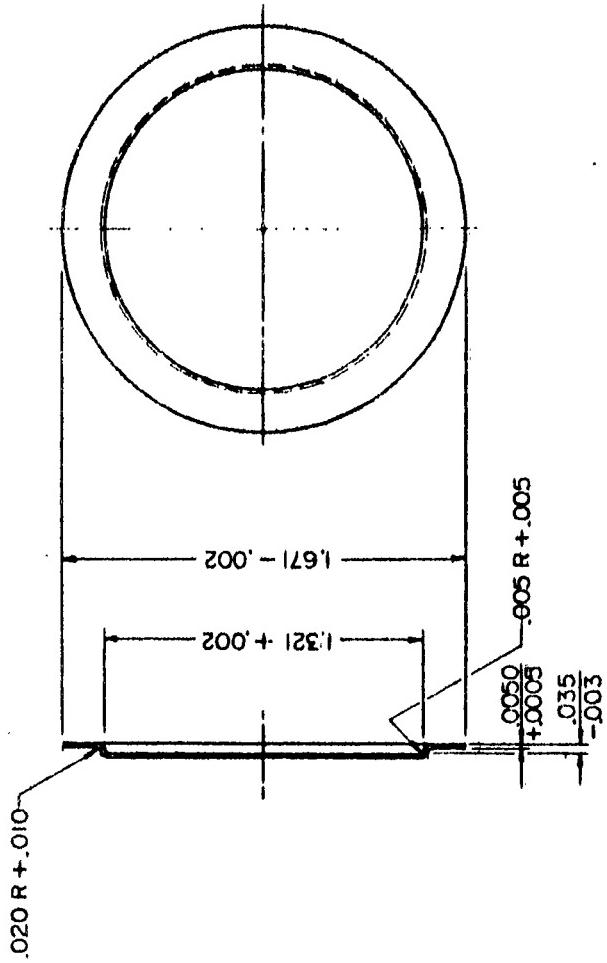
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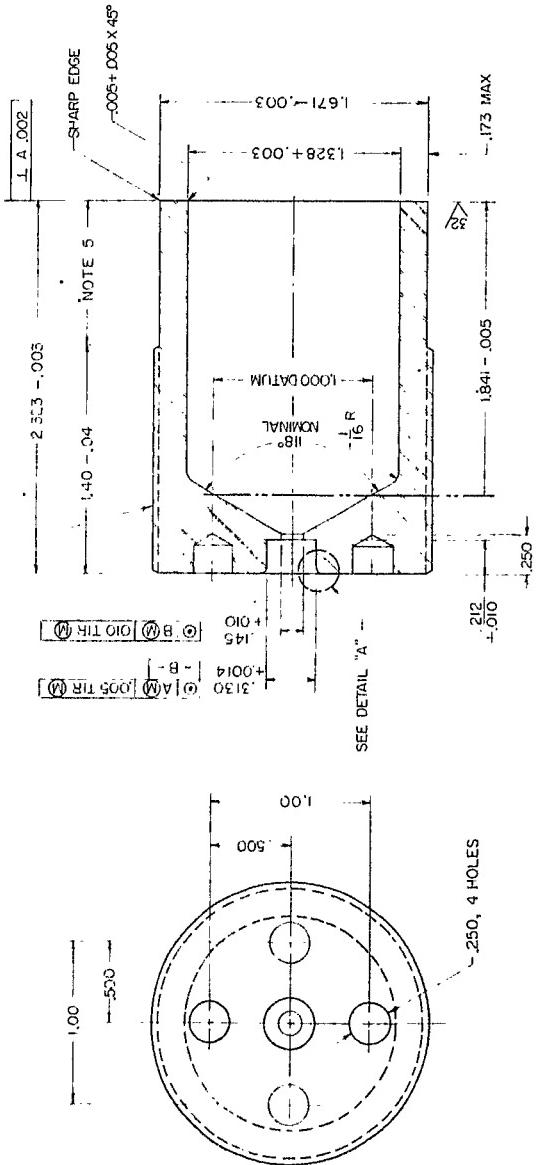
**NOTES :-**

- 1 - SPECIFICATIONS MIL-G-2550, MIL-STD-8 AND LCA-PD- APPLIES.
- 2 - MATERIAL - BRASS STRIP, ALLOY #6 ANNEALED, R5T 65-72, ASTM SPEC B36.
- 3 - DISCOLORATION PERMITTED.

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 FITCH DIA 1.7078 -.20531 [-A-]  
 MINOR DIA 1.6117 MAX



125/ ALL OVER EXCEPT AS NOTED

#### NOTES:-

- 1 - SPECIFICATIONS MIL-G-25550, MIL-STD-8, MIL-STD-10 AND LCA-P0 - APPLY

2 - MATERIAL-STEEL, BAR, COLD-FINISHED, GRADES 1200 TO 1300, EXCEPT RESULPHURIZED GRADES, ASTM SPEC A102 GRAIN SIZE 5-8 PER ASTA SPEC E13

3 - ZINC PLATE; CLASS 3, TYPE II, BRASS COLOR, SPEC QQ-Z-325. BAKE AT 375°F FOR 3 HOURS IMMEDIATELY AFTER PLATING.

4 - SHAPE OF ENTRANCE TO PRIMER POCKET MAY VARY PROVIDED ALL SURFACES BLEND SMOOTHLY WITH EACH OTHER AND WITH PRIMER POCKET SIDEWALL AND BASE OF CASE PLUG. ALL SURFACES MUST BE WITHIN THE ZONE FORMED BY A .030 R-.010 TANGENT TO PRIMER POCKET SIDEWALL AND BASE OF CASE PLUG.

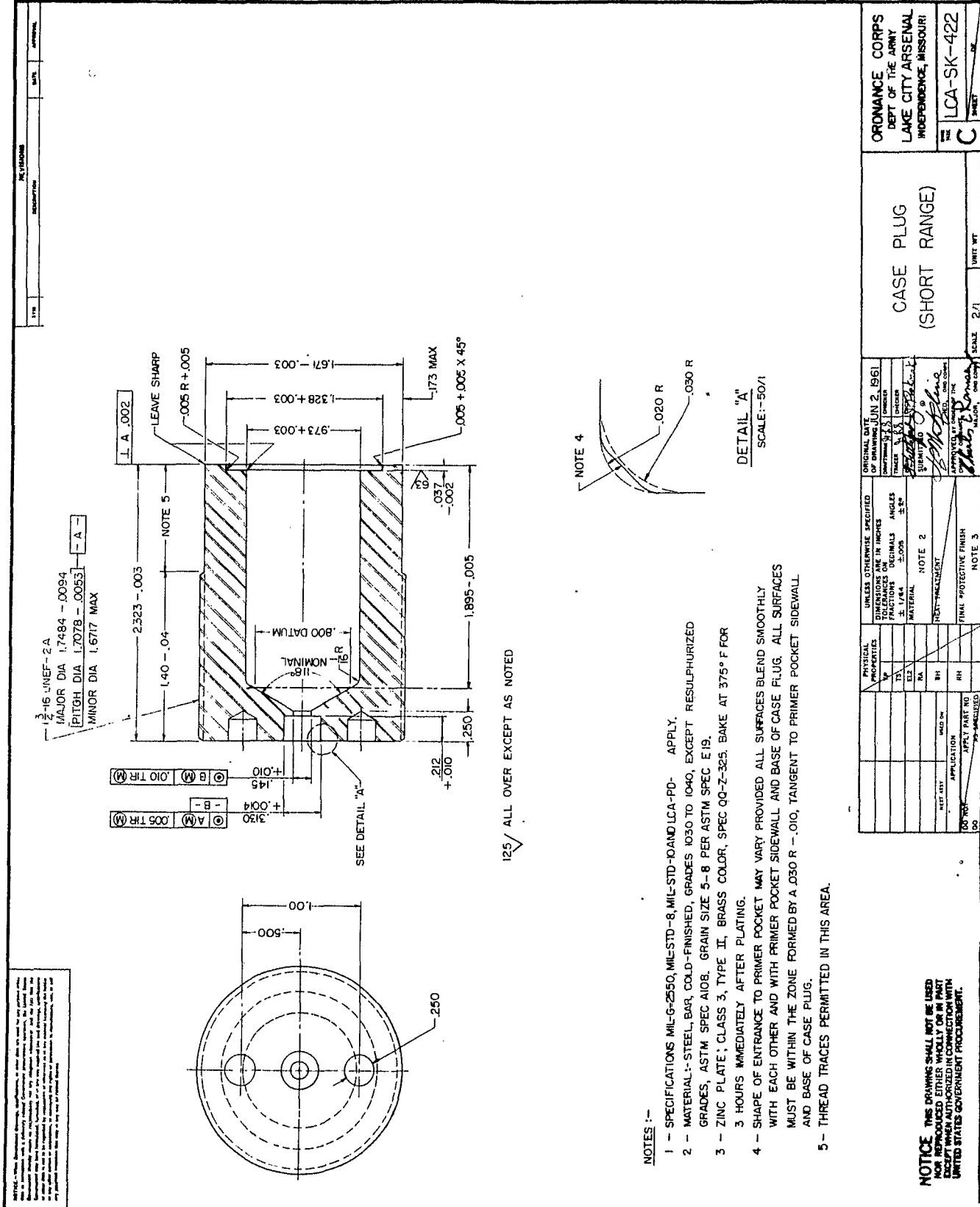
5 - THREAD TRACES PERMITTED IN THIS AREA.

5 - THREAD TRACES PERMITTED IN THIS AREA.  
AND BASE OF CASE PLUG.

DETAIL "A"  
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TYPE	REVISION	DATE	BY
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**TABLE I**

HOLE SYMBOL	HOLE CIRCLE DIAMETER	NO. HOLES	ANGULAR SPACING
"A"	.216	6	60°
"B"	.432	12	30°
"C"	.648	18	20°
"D"	.865	24	15°
"E"	1.148	24	15°

-#52 (0.635) DRILL, 84 HOLES  
(SEE TABLE I FOR LOCATION)

-SHARP EDGE  
.015 R+.005 OR .015+.005 X 45°

-005 R+.005  
.005 + .005 X 45°

125 / ALL OVER EXCEPT AS NOTED

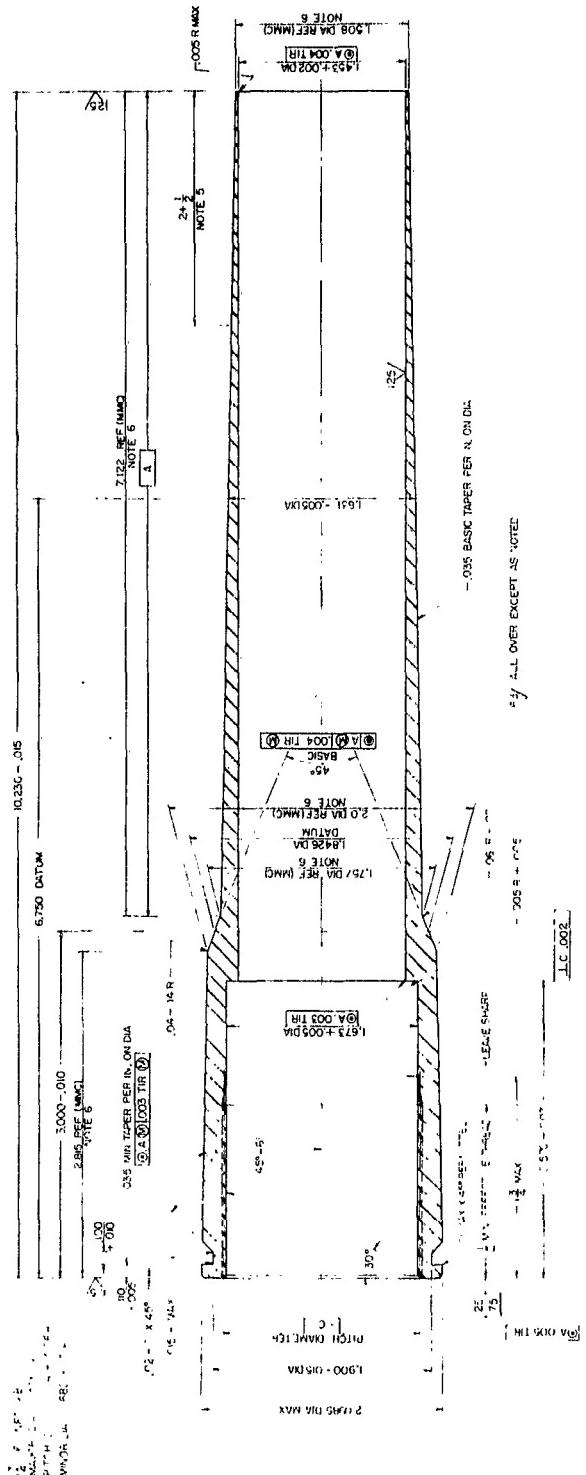
NOTES:-

- 1 - SPECIFICATIONS MIL-G-2550, MIL-STD-8, MIL-STD-10 AND LCA-PD- APPLY.
- 2 - MATERIAL: STEEL, BAR, STAINLESS, TYPE 420 OR 420 F, ASTM SPEC A276.
- 3 - GRIND 32/ FINISH AFTER DRILLING HOLES.
- 4 - HARDEN AND TEMPER TO ROCKWELL C44 TO C49.

METERING DISC

PHYSICAL PROPERTIES	UNLESS OTHERWISE SPECIFIED	ORIGINAL DATE	DRAWING JUN 2, 1961
	DIMENSIONS ARE IN INCHES	TOLERANCES	1/16 INCHES
	FRACTIONS	DECIMALS	ANGLES
P	± .005	.005	± 2°
T	± .005	.005	± 2°
EZ	± .005	.005	± 2°
EA	± .005	.005	± 2°
MM	± .005	.005	± 2°
MATERIAL	NOTE 2		
WEIGHT	ONE LB	ONE LB	ONE LB
APPLICATION	RH	RH	RH
FINISH	NOTE 4		
APPLY NO. 10 COAT	NOTE 4		
DO NOT SCALE	NOTE 4		

LCA-SK-424.  
**C** SHEET



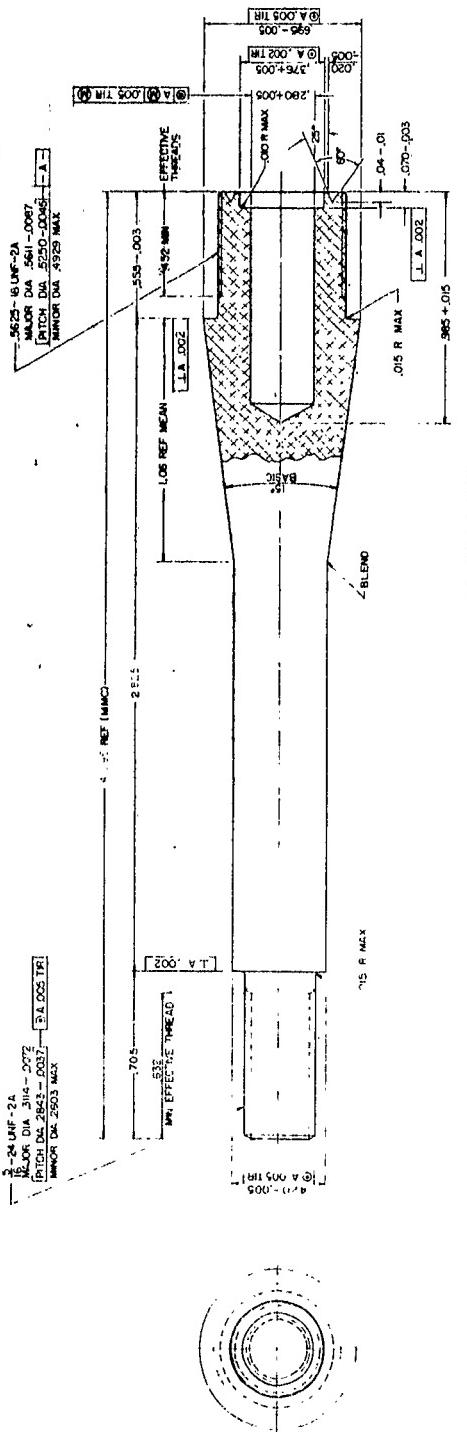
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		NOTE 2	
		NOTE 3	
		NOTE 4	
		LCA-SK-423	
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		FOR TAIL BOOM	
		FOR TAIL BOOM C-156-447	
		SEE ENGINEERING RECORDS	
		LCA-SK-444	



NOTES -  
 1 - SPEC F-27-A, MIL-S-2550 MIL-S-5705 MIL-S-5705-A  
 2 - WATERFALL ALUMINUM ALLOY 2024-T3  
 3 - INTERFACE MATERIAL ALUMINUM ALLOY 2014-T4 ASTM SPEC R21  
 4 - ADP-3

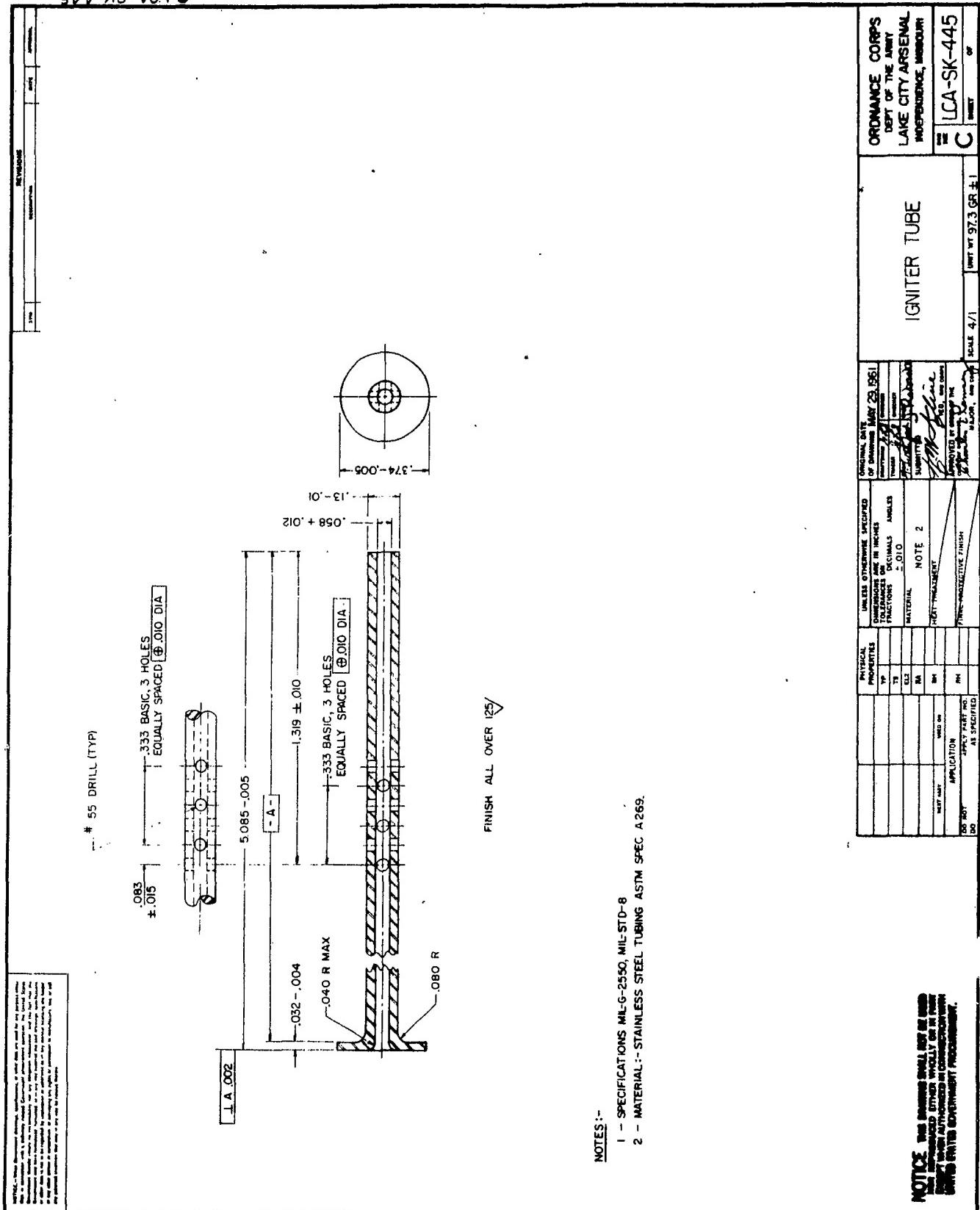
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<table border="1"> <thead> <tr> <th colspan="2">PHYSICAL PROPERTIES</th> <th colspan="2">UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES</th> <th>ORIGINAL DATE OF DRAWING JUN 14 1961</th> </tr> <tr> <th>IP</th> <th>TS</th> <th>FRACTIONS</th> <th>DECIMALS</th> <th>DRAFTERMAN CHICKER</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> <td></td> <td>TRACER CHICKER</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>SUBMITTED BY <i>J. P. B. S.</i> E.D. ORD COPIES</td> </tr> <tr> <td>EL 2</td> <td>RA</td> <td>MATERIAL</td> <td>NOTE 2</td> <td>APPROVED BY ORDER OF THE</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>CHIEF OF ORDNANCE</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>MAJOR, ORD CHICKER</td> </tr> <tr> <td>NEXT ASSY</td> <td>USED ON</td> <td>BH</td> <td>HEAT-TREATMENT</td> <td><i>J. P. B. S.</i></td> </tr> <tr> <td>APPLICATION</td> <td></td> <td>RH</td> <td>FINISH-PROTECTIVE FINISH</td> <td></td> </tr> <tr> <td>DO NOT</td> <td>APPLY PART NO.</td> <td></td> <td></td> <td></td> </tr> <tr> <td>DO</td> <td>AS SPECIFIED</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>					PHYSICAL PROPERTIES		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		ORIGINAL DATE OF DRAWING JUN 14 1961	IP	TS	FRACTIONS	DECIMALS	DRAFTERMAN CHICKER					TRACER CHICKER					SUBMITTED BY <i>J. P. B. S.</i> E.D. ORD COPIES	EL 2	RA	MATERIAL	NOTE 2	APPROVED BY ORDER OF THE					CHIEF OF ORDNANCE					MAJOR, ORD CHICKER	NEXT ASSY	USED ON	BH	HEAT-TREATMENT	<i>J. P. B. S.</i>	APPLICATION		RH	FINISH-PROTECTIVE FINISH		DO NOT	APPLY PART NO.				DO	AS SPECIFIED			
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				SUBMITTED BY <i>J. P. B. S.</i> E.D. ORD COPIES																																																							
EL 2	RA	MATERIAL	NOTE 2	APPROVED BY ORDER OF THE																																																							
				CHIEF OF ORDNANCE																																																							
				MAJOR, ORD CHICKER																																																							
NEXT ASSY	USED ON	BH	HEAT-TREATMENT	<i>J. P. B. S.</i>																																																							
APPLICATION		RH	FINISH-PROTECTIVE FINISH																																																								
DO NOT	APPLY PART NO.																																																										
DO	AS SPECIFIED																																																										
<p style="text-align: right;">SCALE 4/1      UNIT WT 6 GR APPROX</p> <p style="text-align: right;">B</p> <p style="text-align: right;">LCA-SK-440</p>																																																											

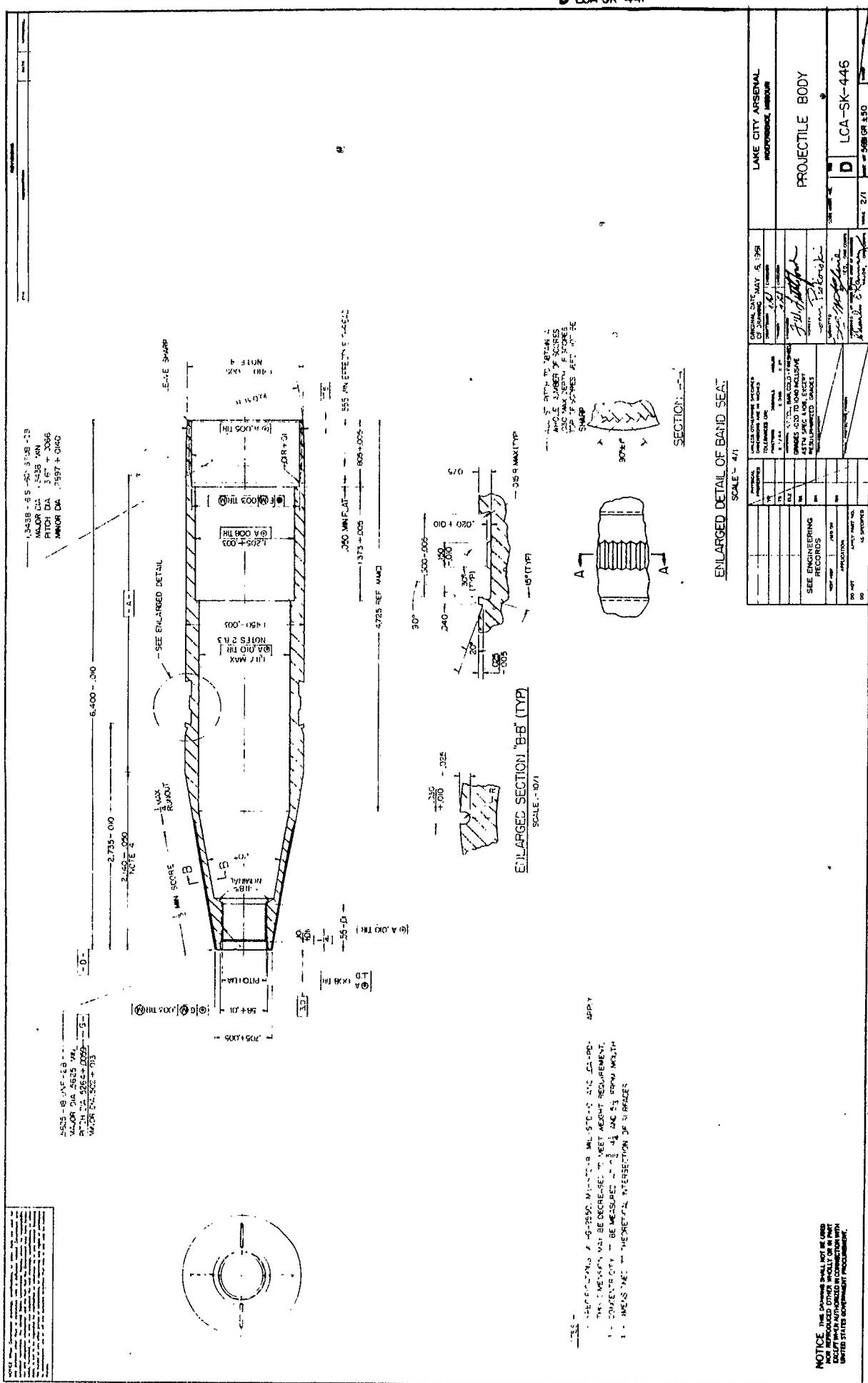
B-LCA-SK-441



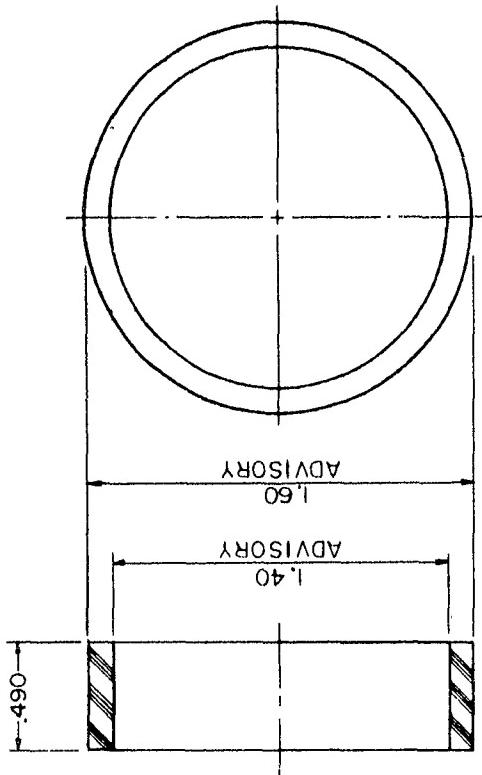




D LCA-8K-441f



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EXCEPT WHEN AUTHORIZED IN CONNECTION WITH  
UNITED STATES GOVERNMENT PROCUREMENT.



NOTES :-

- 1 - SPECIFICATIONS : MIL-G-2550, MIL-STD-8 AND LCA-PD-.  
2 - MATERIAL: MOLDING PLASTIC (FE-FLUOROCARBON RESIN) SPEC MIL-M-14077.  
ALTERNATE MATERIAL: LEAD TIN ALLOY, ALLOY GRADE 10B, ASTM SPEC B 32.

PHYSICAL PROPERTIES		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		ORIGINAL DATE OF DRAWING JUN 5, 1961	
TP		FRACTIONS	DECIMALS	TRACER	CHICKEN
TS				TS	TS
EL. 2				EL. 2	EL. 2
RA		MATERIAL	NOTE 2	RA	RA
BH			HEAT-TREATMENT	BH	BH
NEXT ASSY	USED ON				
APPLICATION				RH	RH
DO NOT	APPLY PART NO.				
DO NOT	AS SPECIFIED				

FINAL PROTECTIVE FINISH

APPROVED BY ORDER OF THE  
CHIEF OF ORDNANCE  
*[Signature]*  
MAJOR ORDNANCE  
CONTROLLER

DRAWN BY [Signature]  
C. H. [Signature]  
DRAFTSMAN

SUBMITTED BY [Signature]  
C. H. [Signature]  
S. C. [Signature]  
OBTURATING, BAND

BLANK

SCALE 2/1

UNIT WT 12.8 GR APPROX

ORDNANCE CORPS  
DEPT OF THE ARMY  
LAKE CITY ARSENAL  
INDEPENDENCE, MISSOURI

DWG. SIZE B

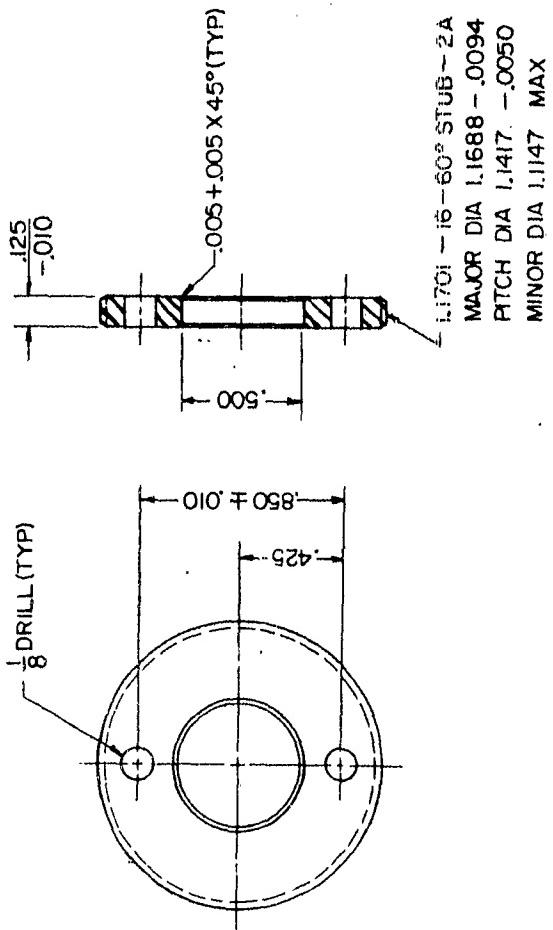
LCA-SK-448

B-1 CA-SK-449

REVISIONS		APPROVAL
SYM	DESCRIPTION	DATE

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UNITED STATES GOVERNMENT PROCUREMENT.

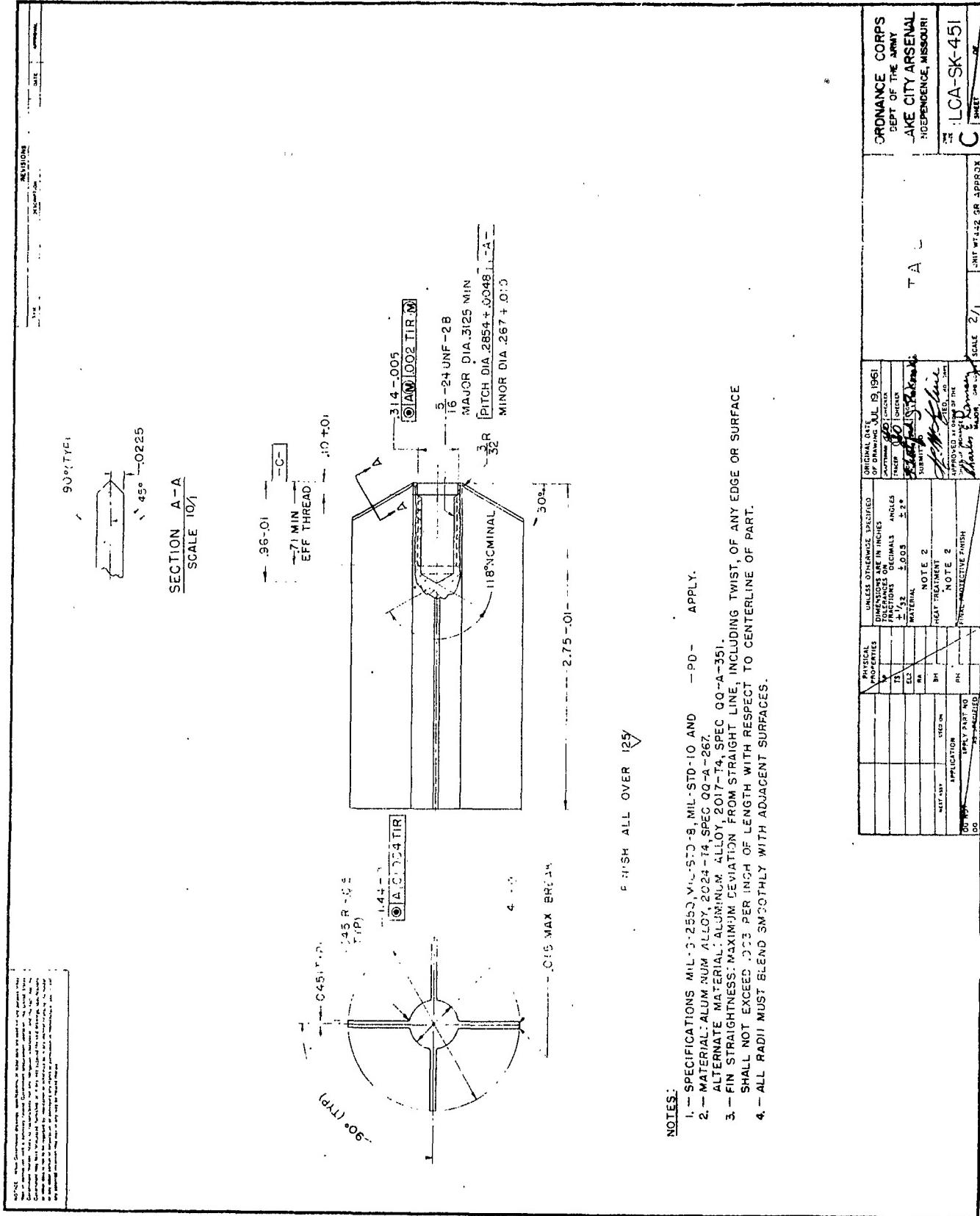
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OR USED IN ANY WAY UNLESS APPROVED BY THE GOVERNMENT.



## NOTES :-

- 1 - SPECIFICATIONS MIL-G-2550, MIL-STD-8
  - 2 - MATERIAL:-STEEL, BAR, COLD-FINISHED, GRADES C 1030 TO C1040, ASTM SPEC A 108. GRAIN SIZE 5-8 PER ASTM SPEC E 19.
  - 3 - ZINC PLATE; CLASS 3, TYPE II, SPEC QQ-Z-325: BRASS COLOR.







REF. NO.	DRAWING NO.	DATE	REVISION																																								
#52 (063) DRILL 84 HOLES (SEE TABLE I FOR LOCATION)																																											
<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>HOLE SYMBOL</th> <th>HOLE DIAMETER</th> <th>NO. HOLES</th> <th>ANGULAR SPACING</th> </tr> </thead> <tbody> <tr> <td>"A"</td> <td>.307</td> <td>6</td> <td>60°</td> </tr> <tr> <td>"B"</td> <td>.414</td> <td>12</td> <td>30°</td> </tr> <tr> <td>"C"</td> <td>.621</td> <td>18</td> <td>20°</td> </tr> <tr> <td>"D"</td> <td>.828</td> <td>24</td> <td>15°</td> </tr> <tr> <td>"E"</td> <td>1.035</td> <td>24</td> <td>15°</td> </tr> </tbody> </table>								HOLE SYMBOL	HOLE DIAMETER	NO. HOLES	ANGULAR SPACING	"A"	.307	6	60°	"B"	.414	12	30°	"C"	.621	18	20°	"D"	.828	24	15°	"E"	1.035	24	15°												
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1. SPECIFICATIONS MIL-T-2550, MIL-STD-8, MIL-STD-10 AND LCA-PD-X APPLY. 2. MATERIAL: STEEL, EA, STAINLESS, TYPE 420 OR 420F, ASTM SPEC A276. 3. GRIND 32/ FINISH AFTER DRILLING HOLES. 4. HARDEN AND TEMPER TO ROCKWELL C44 TO C49.																																											
125/ ALL OVER EXCEPT AS NOTED.																																											
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;">PHYSICAL PROPERTIES</td> <td style="width: 10%;">UNLESS OTHERWISE SPECIFIED</td> <td style="width: 10%;">ORIGINAL DATE OF DRAWING JUN 5, 1961</td> </tr> <tr> <td colspan="2">DIMENSIONS ARE IN INCHES</td> <td>REVISIONS</td> </tr> <tr> <td colspan="2">TOLERANCES ARE IN INCHES</td> <td>1.000</td> </tr> <tr> <td colspan="2">DIMINISHING TOLERANCES</td> <td>0.005</td> </tr> <tr> <td colspan="2">MATERIAL</td> <td>STEEL</td> </tr> <tr> <td colspan="2">NOTES</td> <td>2</td> </tr> <tr> <td colspan="2">HEAT TREATMENT</td> <td></td> </tr> <tr> <td colspan="2">APPLIQUATION</td> <td></td> </tr> <tr> <td colspan="2">NOTICE</td> <td>FOR P.A. CASE AA-44-1666</td> </tr> <tr> <td colspan="2">NOTICE</td> <td>SHARP EDGES, CARE</td> </tr> <tr> <td colspan="2">NOTICE</td> <td>DO NOT USE IN CONNECTION WITH THE</td> </tr> <tr> <td colspan="2">NOTICE</td> <td>UNITED STATES GOVERNMENT PROCUREMENT.</td> </tr> </table>								PHYSICAL PROPERTIES	UNLESS OTHERWISE SPECIFIED	ORIGINAL DATE OF DRAWING JUN 5, 1961	DIMENSIONS ARE IN INCHES		REVISIONS	TOLERANCES ARE IN INCHES		1.000	DIMINISHING TOLERANCES		0.005	MATERIAL		STEEL	NOTES		2	HEAT TREATMENT			APPLIQUATION			NOTICE		FOR P.A. CASE AA-44-1666	NOTICE		SHARP EDGES, CARE	NOTICE		DO NOT USE IN CONNECTION WITH THE	NOTICE		UNITED STATES GOVERNMENT PROCUREMENT.
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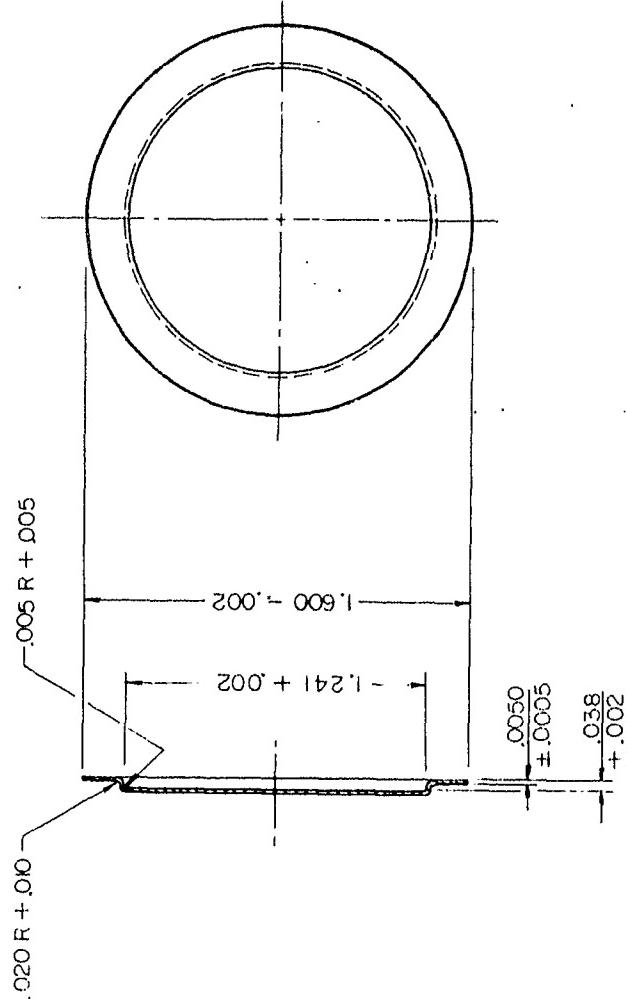
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UNITED STATES GOVERNMENT PROCUREMENT.

B-LCA-SK-426

REVISIONS		DATE	APPROVAL
STN	DESCRIPTION		

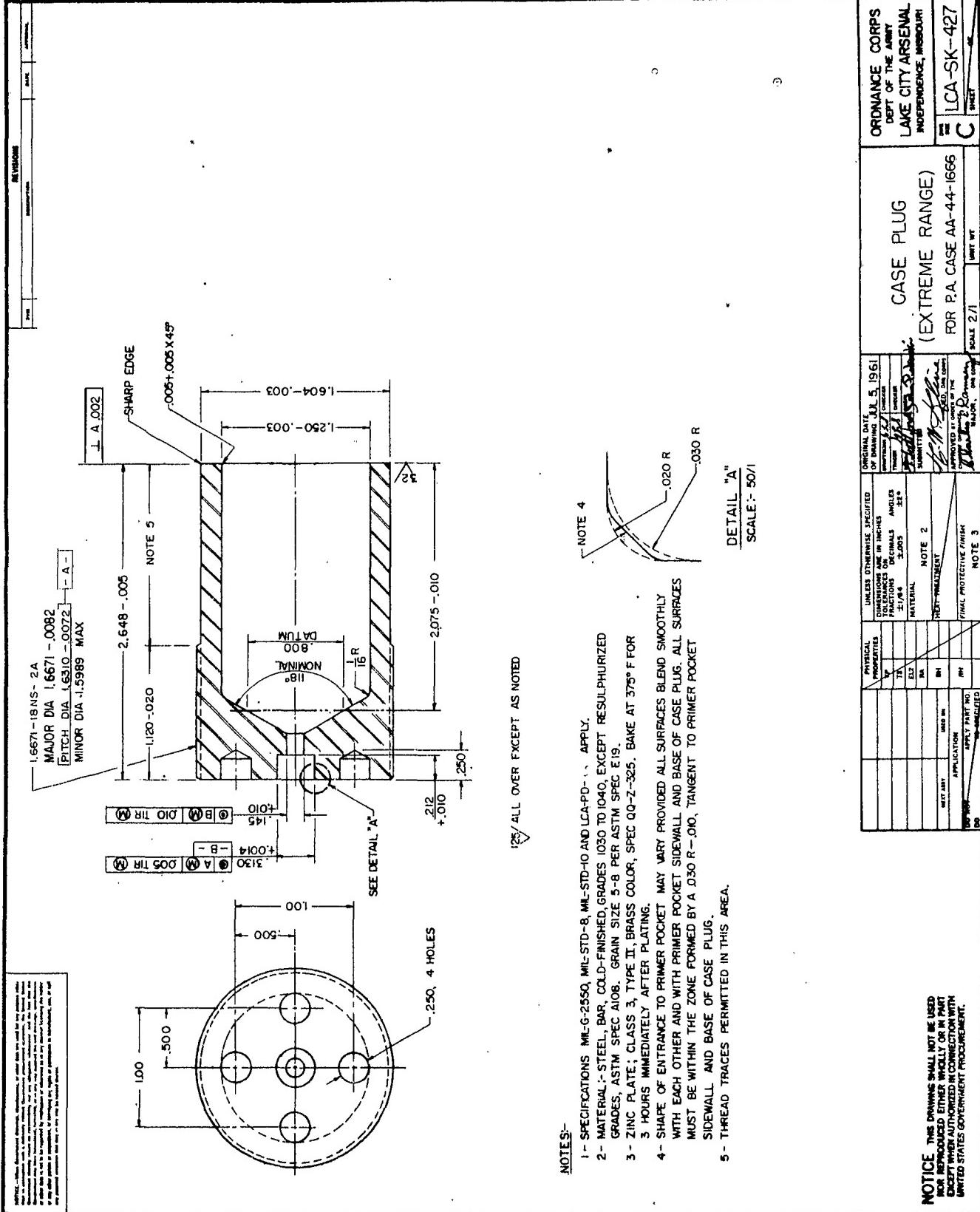
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EXCEPT WHEN AUTHORIZED IN CONNECTION WITH  
UNITED STATES GOVERNMENT PROCUREMENT.

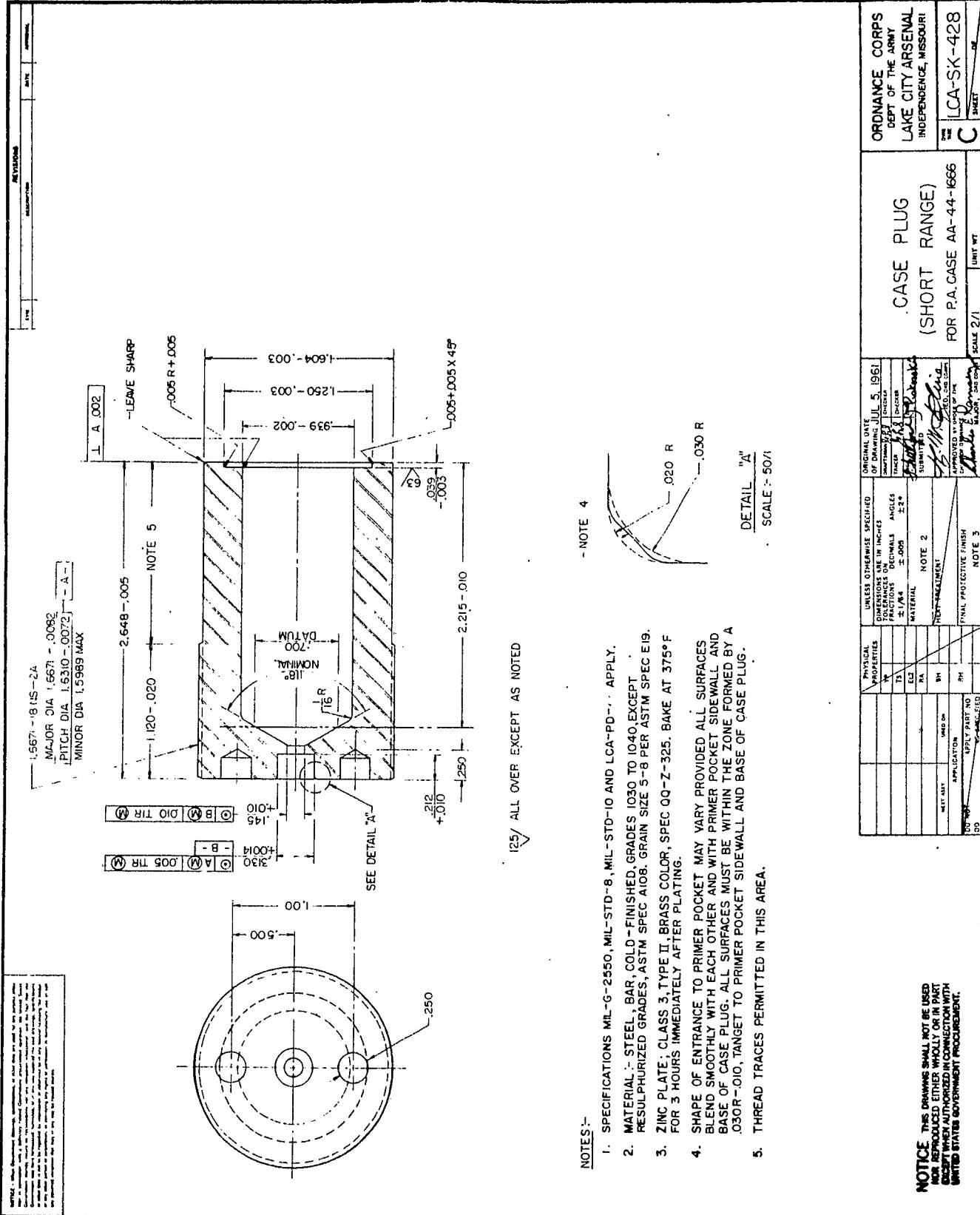
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**NOTES**

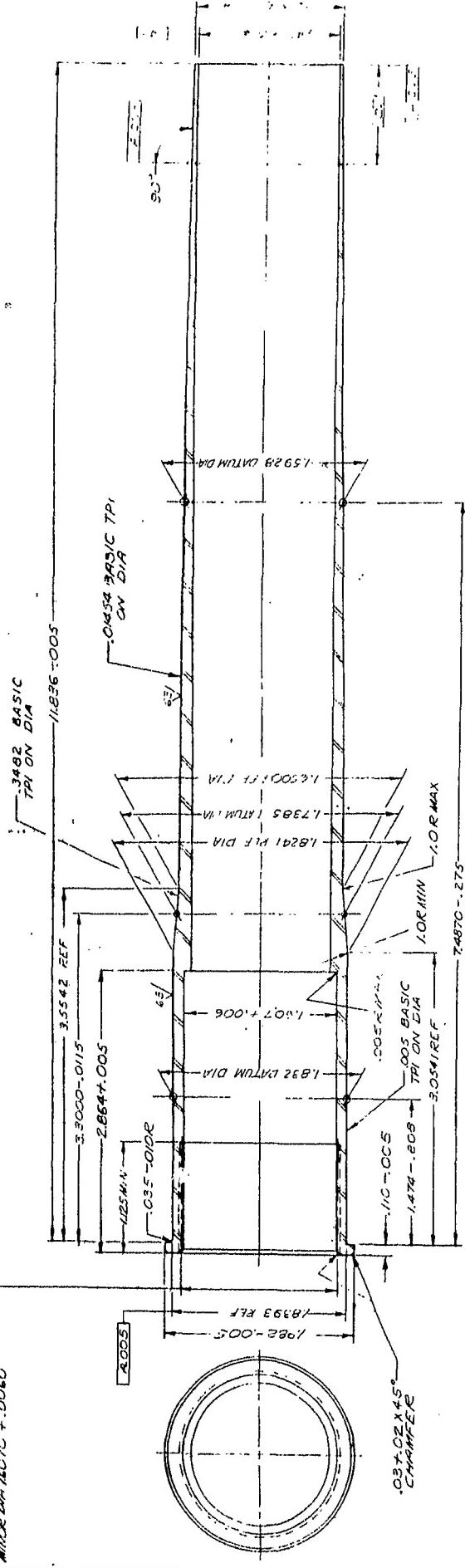
- 1 - SPECIFICATIONS MIL-G-2550C, MIL-STD-8 AND LCA-PD- APPLY.
- 2 - MATERIAL - BRASS STRIP, ALLOY # 6 ANNEALED, R 5T 65-72, ASTM SPEC B 36
- 3 - DISCOLORATION PERMITTED.

ORDNANCE CORPS DEPT OF THE ARMY LAKE CITY ARSENAL INDEPENDENCE, MISSOURI		METTERING DISC COVER	
		DWG SIZE	LCA-SK-426
SCALE	B	SHEET	1
APPROVED BY ORDER OF THE CHIEF OF ORDNANCE LAWRENCE, KANSAS W.D.C., ORD CORPS	APPROVED BY ORDER OF THE CHIEF OF ORDNANCE LAWRENCE, KANSAS W.D.C., ORD CORPS	SCALE 2/1	UNIT WT
PHYSICAL PROPERTIES	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES FRACTIONS DECIMALS ANGLES DECIMALS	ORIGINAL DATE OF DRAWING JU 5, 1961	
YP	DRFTMAN 22 CHECKER	DRFTMAN 22 CHECKER	
TS	TRACER 422 CHECKER	TRACER 422 CHECKER	
EL 2	MAILED 11/12/61 SUBMITTED 11/12/61	MAILED 11/12/61 SUBMITTED 11/12/61	
RA	NOTE 2	NOTE 2	
NEXT ASSY	HEAT-TREATMENT	HEAT-TREATMENT	
USED ON	RH	RH	
APPLICATION	FRITH-PROTECTIVE FINISH	FRITH-PROTECTIVE FINISH	
DO NOT	APPLY PART NO AS SPECIFIED	APPLY PART NO AS SPECIFIED	





16571-18 N5 -26  
ROLL DIA 16.671 MM.  
PITCH DIA 16.315 +.0072  
WHEEL DIA 16.070 + .0060



NOTES:  
1-SAC MIL-G-2554C MIL-STC-B MIL-STC-C MIL-STC-D MIL-STC-E  
2-MIL-STD-704 MIL-STD-704A MIL-STD-704B MIL-STD-704C MIL-STD-704D MIL-STD-704E  
3-MIL-STD-704F MIL-STD-704G MIL-STD-704H MIL-STD-704I MIL-STD-704J MIL-STD-704K  
4-MIL-STD-704L MIL-STD-704M MIL-STD-704N MIL-STD-704O MIL-STD-704P MIL-STD-704Q  
5-MIL-STD-704R MIL-STD-704S MIL-STD-704T MIL-STD-704U MIL-STD-704V MIL-STD-704W  
6-MIL-STD-704X MIL-STD-704Y MIL-STD-704Z MIL-STD-704AA MIL-STD-704BB MIL-STD-704CC  
7-MIL-STD-704DD MIL-STD-704EE MIL-STD-704FF MIL-STD-704GG MIL-STD-704HH MIL-STD-704JJ

ORDNANCE CORPS	
DEPT OF THE ARMY	
D	
NAME	GRADE
SEE ADVICE	SEE ADVICE
REMARKS	REMARKS

## **VII. APPENDIX B**

### **References**

APPENDIX B (1)  
ORDNANCE CORPS  
PICATINNY ARSENAL  
DOVER, NEW JERSEY

Mr RDecker/vjt/72205

IE

IN REPLY  
REFER TO:

APR 7 '61

ORDBB -TW4

SUBJECT: Cartridge, XM415E3.

THE ORIGINAL DOCUMENT WAS OF POOR QUALITY. BEST POSSIBLE REPRODUCTION FROM COPY FURNISHED ASTIA.

TO: Commanding Officer  
Lake City Arsenal  
ATTN: ORDCM-IE, Mr. J. Piskorski  
Independence, Missouri

1. It is requested that your Arsenal conduct a production engineering study of subject Cartridge and recommend any changes leading to reduction of manufacturing costs, broadening of supply base, improving reproducibility, or reduction of acceptance inspection costs while maintaining high assurance of conformance to design. Monthly reports, due at this Arsenal by the 5th day following the reporting period, and a final report, due by 30 June 1961, are required with the study.

2. A set of photo prints covering subject Cartridge was furnished to Mr. F. W. Littleford, of your Arsenal, on 16 March 1961.

3. Funding of \$6,000.00 is being forwarded to your Arsenal for the above study.

FOR THE COMMANDER:

D. Trevornow

D. TREVORNOW  
Deputy Director  
for Army Ordnance

cc: Ord Wpns Comd  
ATTN: Major Rodgers

## APPENDIX B (2)

## WORK ORDER

1. DRDNCE Ammo Command (Lake City Arsenal) ORDLY-AM	2. TO:			3. DATE 11 April 61
FROM: Commanding Officer Picatinny Arsenal, Dover, N.J.	FROM:			4. DOCUMENT CONT. NUMBER 1.02.024.010.010.0
5. OMS CODE AND TITLE  4010.15.0033.2.00.54 XM28 and XM29 Weapons System	7. ELEMENTS	A. QUANTITY UNIT:	B. UNIT PRICE	C. TOTAL COST
	PRIOR			10,000
	INCREASE			6,000
6. APPROPRIATE ACCOUNTING CLASS. OF FUNDS (TO BE) MADE AVAILABLE  21 X2030                    105-3115 P4011                      S/23-012	DECREASE			
	CURRENT			16,000
	TOLERANCE			

## 8. PERFORMANCE OF THE FOLLOWING WORK IS AUTHORIZED (SUBJECT TO AVAILABILITY OF FUNDS)

The purpose of this AOS-20 is to provide additional authority for the following. To conduct production engineering study on Cartridge XM415E3.

Reference: Letter from PA to LCA dated 7 Apr 61.

Subject: Cartridge XM415E3, signed D. Trevarrow.

THE ORIGINAL DOCUMENT WAS OF POOR  
QUALITY. BEST POSSIBLE REPRODUCTION  
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## 9. DELIVERY SCHEDULE AND INSTRUCTIONS

Activity of this order must be initiated on or before 17 April 1961 and all activity must be completed on or before 30 June 1961.

## 10. ENCLOSURES

None

FOR USE BY ADDRESSEE	11. AUTHORIZED BY  ORDEB-TP-2 E. Rubin TYPED NAME & TITLE	S. J. Schmid, Jr., P.E. 13 April 1961 SIGNATURE AND DATE
12. CONTRACT ACTIONS A. DATE B. NUMBER C. AMOUNT		

## VII. APPENDIX C

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Commanding General Aberdeen Proving Ground ATTN: Mr. Goodwin Morrow Technical Library Maryland	1 1
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VII. APPENDIX C

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